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Original Research

Uropathogens pattern in urinary tract infections among children in Arar, Saudi arabia

Shehab Ahmed Alenazi
Department of Pediatrics, Faculty of Medicine, Northern Border University, Arar, Saudi Arabia

Abstract

Aim: The current study evaluated UTI among Saudi children in the Northern Border region regarding their predisposing factors, causative uropathogens and antibiotic sensitivity.

Material and Methods: The retrospective study enrolled children (0-14 years old) who attended to Arar Maternity & Pediatric Hospital from in 2017-2022 with discharge a final discharge diagnosis as of UTI according to following the American Academy of Pediatrics (AAP) Clinical Practice Guidelines.

Results: UTI was reported in 606 cases during the study period. It was more prevalent among boys' male infants under one year of below the age of one year, while in girls, it was more common in girls at the age above 6 years. High- grade fever, dysuriea, foul- smelling urine and loin pain were the most commonest presentations. Recurrent UTI was reported in 30.4% of UTI cases. Constipation was the most commonest reported risk factors (32.7% of the diagnosed children). Structural anomalies were the most commonest predisposing factors among recurrent UTI cases. Escherichia coli (E.coli) and Klebsiella were the most commonest causative organisms (56.4 %, and 28.9 % of cases, respectively). Culture and sensitivity test data showed that E.coli were most sensitive to IMP, Ceftriaxone (CTR) & TZP in about 98.5 %, 84.8 % and 74.6 % of cases, respectively. While Klebsiella was sensitive to IMP, TZP & Amikacin (AMK) in about 42.3 %, 34.3 % and 33.7 % of cases, respectively.

Discussion: The Ccurrent data showed that UTI is a common health problem among children in the Northern Border region and provide insights give data intoabout its uropathogens and their antibiotic response characteristics, which can help in management plans.

Keywords

Urinary Tract Infection, Klebsiella, E.Coli, Microbial Sensitivity, Arar

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Corresponding Author: Shehab Ahmed Alenaz, Department of Pediatrics, Faculty of Medicine, Northern Border University, Arar, Saudi Arabia.
Email: alenazishehabi@gmail.com P: +96 655 538 55 78
Corresponding Author ORCID ID: https://orcid.org/0000-0002-6231-2785
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Introduction

Urinary tract infections (UTI) are considered to be the a serious health problem among children; worldwide,with reported around 6 million children suffering from UTI attend consult outpatient departments and nearly 300,000 are admitted to the ward -admitted children worldwide [1]. Urinary tract infections (UTIs) are amongst the most commonest infections in children that if not timely treated, can lead to renal injury and systemic illnesses such as hypertension or even kidney failure in the future [2]. It is reported that 3% to 5% of girls develop their first attack of UTI by 5 years of age, whereas, about 1% of boys who develop their first UTI in the first year of life, especially those who have not beenare uncircumcised [3]. It is also reported that recurrent UTI also is a very common problem in pediatric patients, as it may lead to renal scarring, hypertension and even end-stage kidney disease [4]. Mainly UTI could can mainly be caused by bacteria, but other organisms could may also be responsible, e.g. viruses, parasites and fungi. Gram-negative bacteria are most common, especially E.coli, which is 70-90% responsible for 70-90% of UTIs in children [5]. Other groups of uropathogens are proteus, klebsiella, pseudomonas and actinobacter, etc., whereas only 10 % could may be Gram-positive bacteria like enterococcus, staphylococcus and strepreptococcus agalactiae [6].

As the antibiotic use has been on the rise in the recent years, the incidence of multidrug resistance among the uropathogens has increased worldwide [7]. One study showed that more than 80% of uropathogens in developing countries are now resistant to trimethoprim or trimethoprim-sulfamethoxazole [8]. Many clinicians in developing countries encountered that UTI alone could be the cause of significant morbidity and mortality [9, 10]. Several other studies have documented the emergence of resistant uropathogens and their susceptibility pattern to commonly used antimicrobial agents in order to guide the choice of empiric therapy all over the world [11,12]. As resistance rates differ worldwide against to commonly used drugs against bacterial infection differ worldwide, the knowledge of local etiology and susceptibility profile could support the most effective empirical treatment. We found very limited data about the present study in other areas of Saudi Arabia. To the best of our knowledge, there are currently no published similarat present, no such studies have been published describing the prevalence and spectrum of uropathogens in pediatric patients and their antimicrobial susceptibility patterns in the Northern Border province. Therefore, this research was conducted to investigate with the aim of investigating the prevalence and patterns of antibiotic resistance of uropathogens among pediatric patients (0-14 years) at Maternity & Pediatric Hospital, Arar city, Kingdom of Saudi Arabia.

Material and Methods

Arar city is the capital of the Northern Border region of Saudi Arabia. This study is a retrospective The current study is a retrospective study in which the medical records of children who attended to the Maternity & Pediatric Hospital in Arar and were diagnosed as with UTI between in the duration from 1st January 1, 2013 to and 31st December 31, 2018 were collected and reviewed. Were collected and studied. The study design was approved by the local bioethics committee of Northern Border University to get access to the patients' data. Data confidentiality will bewas considered in all research steps.

The For children (0-14 years old) with a final discharge final diagnosis as of Urinary tract infection (UTI), medical records data were collected regarding their demographic data (ages and genders), clinical presentations, predisposing factors for UTI and the laboratory and radiology investigations data were collected for further analysis. Also, the microbial culture results were included with their culture and antibiotics sensitivity assays. UTI was diagnosed following the American Academy of Pediatrics (AAP) Clinical Practice Guidelines [13]., UTI was diagnosed in cases showed bothwhen ≥50,000 cfu/mL of a single uropathogenic organism was detected with a positive urinalysis (at least one of the following criteria were was found: WBC ≥5 cells/hpf, leucocyte esterase positive or presence of bacteria). In addition, patients withshowed the bacterial colony counts of 10,000–100,000 cfu/mL (with pyuria/bacteriuria in urinalysis), were also diagnosed as awith UTI. Recurrent UTI was diagnosed as with at least 3 attacks of UTI within 12 months with complete clinical resolution in between the attacks.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

According to the medical records of Arar Maternity & Pediatric Hospital, patients records 606 children were diagnosed as with UTI during the selected study years (2017-2022). Data regards on the sex and ages of the children enrolled in the study are shown in Table (1). There was a statistically different (p=0.0002; X2=16.96, 2) prevalence of UTI between males and females patients in the different age groups. Most of the children enrolled in the study were under one year of below the age of one year. UTI showed a higher prevalence among children under one year ofbelow the age of one year (46% of the diagnosed cases). Recurrent UTI was reported in 184 cases (30.4% of UTI cases). Recurrent UTI was more common among

Table 1. Age and sex of the children diagnosed as with UTI who attended to Arar maternity and pediatric hospital (2017-2022)

Gender	Male		Female		Total	
	n	(%)	n	(%)	n	(%)
Ages						
<1 year	160	26.4	120	19.8	280	46.2
1-5 years	90	14.9	85	14	175	28.9
6-12 years	55	9.1	96	15.8	151	24.9
Total	305	50.3	301	49.7	606	100

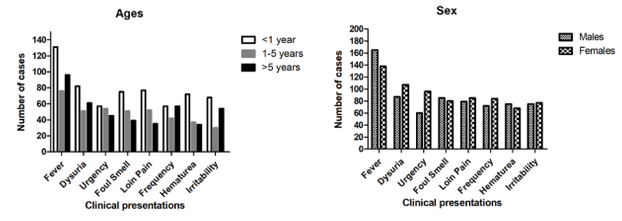

Figure 1. Clinical presentation of the children diagnosed as with UTI who attended to Arar maternity and pediatric hospital (2017-2022) in relation to their age and sex.

Table 2. Clinical presentation of the children diagnosed as with UTI who attended to Arar maternity and pediatric hospital (2017-2022)

Complaints	<1 year				1-5 years				>5 years				Total	
	Males		Females		Males		Females		Males		Females			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
High-grade fever	81	50.6	50	41.7	41	45.6	35	41.2	43	78.2	53	55.2	303	50
Dysuria	43	26.9	39	32.5	27	38	24	28.2	17	30.9	44	45.8	194	32
Foul smelling	44	27.5	31	25.8	26	37	25	29.4	15	27.3	24	25	165	27.2
Loin pain	44	27.5	33	27.5	25	36	27	31.8	10	18.2	25	26.0	164	27.1
Urgency	25	15.6	32	26.7	25	36	29	34.1	10	18.2	35	36.5	156	25.7
Frequency	31	19.4	26	21.7	18	28	24	28.2	23	41.8	34	35.4	156	25.7
Irritability	43	26.9	25	20.8	15	25	15	17.6	17	30.9	37	38.5	152	25.1
Hematuria	43	26.9	29	24.2	20	31	17	20.0	12	21.8	22	22.9	143	23.6
Total No. of cases	160	100	120	100	90	100	85	100	55	100	96	100	606	100

Table 3. Antibiotics sensietivity among children diagnosed as with UTI who attended to Arar maternity and pediatric hospital (2017-2022)

Organism Isolated	AMX		GEN		NOR		TZP		CIP		AMK		T/S		VAN		IMP		CTR		Total of Cases	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
E.coli	46	13.5	81	23.7	139	40.6	255	74.6	53	15.5	241	70.5	46	13.5	0	0	337	98.5	290	84.8	342	56.4
Klebsiella	9	5.1	52	29.7	30	17.1	60	34.3	51	29.1	59	33.7	2	1.1	0	0	74	42.3	51	29.1	175	28.9
Enterococci spp.	22	73.3	29	96.7	30	100	30	100	22	73.3	30	100	22	73.3	29	96.7	30	100	30	100	30	4.95
Proteus	0	0	18	60	30	100	30	100	30	100	15	50	20	66.7	7	23.3	30	100	22	73.3	30	4.95
Staphs	7	53.8	11	84.6	13	100	9	69.2	12	92.3	13	100	4	30.8	13	100	13	100	13	100	13	2.15
Enterobacter	0	0	4	50	0	0	8	100	6	75	6	75	6	75	1	12.5	8	100	7	87.5	8	1.32
Pseudomonas	0	0	2	40	5	100	5	100	5	100	4	80	4	80	3	60	4	80	3	60	5	0.83
Citrobacter	0	0	3	100	3	100	3	100	0	0	3	100	2	66.7	2	66.7	3	100	3	100	3	0.5
Totals	84	13.9	200	33	250	41.3	400	66	179	29.5	371	61.2	106	17.5	55	9.1	499	82.3	419	69.1	606	100

Amoxicillin (amx), Amikacin (amk), Ceftriaxone (ctr), Ciprofloxacin (cip), Gentamicin (gen), Imipenem (imp), Norfloxacin (nor), Tazobactam-Piperacillin (tzp), Vancomycin (van), Trimethoprim-sulfamethoxazole (t/s)

female children (53/81 cases). Recurrent cases were mainly diagnosed at the age below 1 year (98 cases), followed by the age group 1 to 5 years, with reported 65 cases. Regarding the cases management, 338 cases were managed as outpatients (55.8%), while admission was indicated for 268 (43.2%) cases for appropriate management.

Regarding the clinical presentation of children enrolled in the study, high- grade fever, dysuriea, foul- smelling urine and loin pain were the most commonest presentations among the studied cases records (about 50%, 32%, 27.2 , and 27.1 % of cases, respectively). Clinical presentations in relation to the ages and sex of the children enrolled in the study are shown in Figure 1.

According to the patient records, the associated predisposing factors for UTI were reported in 400 cases of the children enrolled in the study. Constipation was the most commonest reported risk factors (32.7% of the diagnosed children). Constipation was the most commonest predisposing factors among children diagnosed as with recurrent UTI (55/184 cases), followed by the Structural anomalies (43/184 cases).

Regarding the bacterial isolated from urine cultures of the diagnosed cases urine culture, E.coli was the most commonest isolated bacteriuma in the cases managed in the outpatient clinics (242/338 cases), while Klebsiella was the most commonest among the admitted cases (105/268 cases).

Culture and sensitivity test in the records of the patients included in the study showed that most bacterial isolates were sensitive to Imipenem (IMP), followed by Tazobactam-piperacillin (TZP). While the lowest sensitivity was shown to Vancomycin (VAN). E.Coli isolates were sensitive to ceftriaxone in 84.8% of cases, while klebsiella isolates were mainly sensitive in around 29% of the diagnosed klebsiella UTI cases (Table 3).

Discussion

Urinary tract infection is a major health condition among children. The current study had investigated the problem among children admittedattended to Arar Maternity and Pediatric Hospital during the time period from January 2017 to December 2022 through a retrospective study of the patients records. According to the hospital patients records for the selected study years (2017-2022), 606 children were diagnosed as with UTI during the selected study years (2017-2022). A There was statistically different prevalence of UTI was revealed amongbetween males and females patients in the different age groups. UTI showed a higher prevalence among children under one year ofbelow the age of one year. Recurrent UTI was reported in 184 cases (30.4% of UTI cases) with a higher prevalence among female children (53/81 cases). Recurrent UTI was reported in 81 cases (13.4% of UTI cases) with a higher prevalence among female children (53/81 cases). Recurrent cases were mainly diagnosed at the age below 1 year. Regarding the cases management, 338 cases were managed as outpatients (55.8%), while admission was indicated for 268 (43.2%) cases for proper management. High- grade fever, dysuriea, foul- smelling urine and loin pain were the most commonest presentations among the studied cases records. Constipation was the most commonest reported risk factors (32.7% of the diagnosed children). Structural anomalies were the most commonest predisposing factors

among children diagnosed as with recurrent UTI. E.coli was the most commonest isolated bacteria in the cases managed in the outpatient clinics, while Klebsiella was the most commonest among the admitted cases. Culture and sensitivity tests in the records of the patients included in the study showed that most bacterial isolates were sensitive to IMP, followed by TZP. While Tthe lowest sensitivity was shown to the antibiotic VAN.

Urinary tract infection (UTI) is the second most commonest bacterial infections of in childhood after middle ear infections. Among febrile infants and children with urinary symptoms, 6%–8% were shown to be UTI [6,14]. Prevalence varies with age and gender. The current data showed that UTIs are higher among female children and infants. This is in accordance with other studies, which showed that UTI prevalence varies with age, peaking in young infants and toddlers. With The higher prevalence reported among females [6], this can be explained by the shorter female urethral distance from the foreskin surface area in females. Also, UTI is significantly higher among the uncircumcised boys (21%), while UTI was reported only in 2% of circumcised boys and 5% of girls during the first year of life [15]. During toddler years, toilet training can lead to volitional holding and bladder stasis, promoting UTIs [16]. Regarding the recurrence of UTI, the current study ratio (30.4%) is the same as the early reported by Karen et al. (2015) [17].

Constipation was the most commonest reported risk factors (32.7% of the diagnosed children). Structural anomalies were the most commonest predisposing factors among children diagnosed as with recurrent UTI. This is in aggreemment with the previously published data showing that impaired urine with urinary stasis, is associated with higher rates of UTI. The impaired normal voiding may be due to structural urinary tract congenital anomalies or functional disorders such as neurogenic bladder, constipation and behavioural withholding [16]. Common risk factors for recurrence include also vesicoureteralvesicoureteric reflux and bladder and intestinal dysfunction were considered as leading risk factors for recurrent cases of UTI [17].

The current data showed that E.coli was the most commonest isolated bacteria in the cases managed in the outpatients, while Klebsiella was the most commonest among the admitted cases. Hameed et al. (2019) [18] reported that E. coli is the most common cause of community-acquired UTIs in children causing three-quarters of all infections in a tertiary hospital in Riyadh, Saudi Arabia. Also, another regional study about children with UTI from Oman showed that E. coli, was responsible for about two-thirds of all diagnosed UTIs among children, while K. pneumoniae was the second most common isolated uropathogen. Internationally, most pediatric UTIs are caused by Gram- negative coliform bacteria [16]. Escherichia coli (E.coli) was has been reported to be found in bacterial cultures of about 80% of UTI cases among children as they have their characteristic fimbriae to that attach to the uroepithelial cell surface, to overcome being flushed by the normal vioiding of urine. Other reported common uropathogens include Klebsiella, Proteus, Enterobacter and Enterococcus species [4,19].

Regarding to the current culture sensietivity data, E.coli and K. pneumonia showed the highest patterns of resistant to the tested antibiotics. E.coli was found to be resistant to co-trimoxazole and amoxicillin/clavulinic acid in about 86.4% of the E.coli UTI cases. This findidng minimizes the role of these antibiotics as empirical therapy for community-acquired UTIs. Also, third- generation cephalospsorin ceftriaxone showed very potent effect against E.coli with a reported 85% sensietiviety, which supports its use as an antibiotic of chioice for empirical therapy of UTI cases. This finding is supportedig to by Hameed et al.'s study (2019) [18] study concluison in Riyadh. While K. pneumonia showed the highest sensietiviety to IMP (around 40% of the diagnosed cases only).

There are The several strengths of our study as is that it was based on a long study duration of five years to investigate properly the burden of the problem of UTI in the Northern Border region of Saudi Arabia with strict inclusion criteria in for diagnosis of UTIs based on AAP definition (positive urinalysis and urine culture).

Limitations

The main limitation of this study is mainly due to beingits retrospective design with some lack of shortage in data recording in some patients files, which were excluded from the current study scope.

Conclusion

The reported data clarify, for the first time, the burden of the problem of UTI problem among the children in Arar. Urinary tract infections were more prevalent among boys' male infants under one year of below the age of one year, while in girls, itthey weres more common in girls at the age above 6 years. High- grade fever, dysuriea, foul- smelling urine and loin pain were the most commonest presentations. Recurrent UTI was reported in 30.4% of UTI cases. Constipation was the most commonest reported risk factors. Structural anomalies were the most commonest predisposing factors among recurrent UTI cases. Escherichia coli (E.coli) and Klebsiella were the most commonest causative organisms. Culture and sensitivity test data showed that E.coli were most sensitive to IMP, Ceftriaxone (CTR) & TZP, While Klebsiella was sensitive to IMP, TZP & Amikacin (AMK).

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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